

**Technology  
for**

# **Alaskan Transportation**

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Transportation Technology  
Transfer Program

## **In This Issue**

**A Plastic Runway for Shishmaref  
Let's Get Acquainted!**  
**1987 Alaska Transportation Forum  
Seminar Planned on Real Estate  
Acquisition**

## **A Plastic Runway For Shishmaref**

Shishmaref is getting a plastic runway at its airport. When completed, it should be strong enough for Hercules cargo planes to land weighing up to 135,000 pounds.

"Shishmaref is getting a better quality airport at the same or lower cost than we could have built using traditional construction methods," said Dan Urbach, chief of the northern region's aviation design group of the Alaska Department of Transportation and Public Facilities (DOT&PF).

Traditional construction methods require gravel—lots and lots of gravel. The airport under construction at Shishmaref will be 5,000-feet long and 77-feet wide, and would require 12,482 cubic yards of gravel.

There isn't enough gravel at Shishmaref for this size of airport. And the available gravel is very poor according to DOT&PF project engineer Patty Miller. Engineers prefer angular gravel with lots of sharp points. The sharp points help the gravel hold together in a foundation or road. Shishmaref has

beach gravel with rounded edges. Worse, the beach gravel has dirt, driftwood and other foreign matter that would have to be removed before it could be used.

Importing the necessary gravel would have skyrocketed the costs. There is very little good gravel in western Alaska. Much of the gravel used for construction must be barged in from other areas. "Gravel at Shishmaref could have cost us up to \$100 per cubic yard by the time we got it to the destination. Almost all of this is freight," said Miller.

Yet gravel provides crucial support for runways and roads. Without the strong foundation that gravel provides, runways can't support the weight of planes landing on them. While Shishmaref doesn't have any top-quality gravel, it does have a great deal of sand.

Sand alone isn't strong enough to support a hard-surfaced runway for very long. Surface pressure and pressure from the weight

(continued on page 2)

## **Let's Get Acquainted!**

This is the first newsletter of a new program that will help Alaskans obtain useful information and training to meet local transportation needs. The program focuses on technology related to roads, bridges, airports, seaports, railroads and public transportation.

Our name is the Transportation Technology Transfer Program.

Besides our free quarterly newsletter, we are tooling up to provide useful services to the diverse spectrum of people in govern-

ment and industry whose work relates to transportation in Alaska. We hope to include in each issue something that will interest everyone regardless of their technical background.

It is really hard to provide something for everyone, so we encourage you to let us know how best to serve you. We will try to tailor our program to your needs.

Our newsletter will report on useful

(continued on page 4)

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and Public Facilities*

## A Plastic Runway

(continued from page 1)

of planes landing and taxiing cause the sand to slide out at the side. The process is similar to jelly oozing out of the side of a sandwich when the bread is squeezed. Only in this case, the pieces of bread are the runway surface at the top and the ground underneath.

Plastic was the answer for Shishmaref.

"This construction involves the use of a plastic confinement grid. This is the first major airport installation of its kind, probably in the world, but definitely in Alaska," said Dr. Nicolaas Coetzee of the Institute of Northern Engineering. "What we are doing there, instead of importing gravel for use in the structural layers of the runway, is to use the grids to confine the natural sand."

Containment grids are honeycomb-shaped sheets of plastic. The ones used at Shishmaref are eight-inches deep, eight-feet wide and 20-feet long. Flattened to 11 feet by four inches by eight inches for shipping, the grids are stretched out to their expanded size for installation. Workmen fill the honeycomb cells with sand. The roughly eight-inch individual honeycombs hold the sand in place.

Coetzee is working on the project through a research contract with the DOT&PF Research Section. He performed the initial computer modeling to determine if the grids would be an acceptable substitute for gravel. Individual simulations of his computer

analyses took up to 23 hours of actual computer operating time to complete.

"The whole idea is to confine the sand," Coetzee said. "If you take a styrofoam cup and stand on it, it'll collapse. If you fill the cup with sand, you can stand on it, and it won't collapse. That's because a tension component is being generated in the cup. The main work is being done by the sand. It's carrying all the vertical load, and it's being held in place by the confining effect of the cup."

The same principle, on a much larger scale, is utilized in the new airport. Sand can't slip out from under the runway because the plastic grid holds it in place.

Military engineers have used plastic webs for years. The military places it on sand beaches to provide roadbeds for equipment during invasions and beachhead supply. Since their needs are temporary, these installations are not paved. Shishmaref's new runway will be used for years, so it was paved.

A paving crew returned to the village this last summer and completed the project. A late spring in 1985 delayed construction. The asphalt layer capping the sand-filled grids was applied this year. After the asphalt paving was installed and cured, the runway was opened for air traffic.

Since this is the first time a plastic grid has been used in Alaska, Coetzee will continue to monitor the runway as it is used via in-

struments he installed in two of the grids. Using data from the instruments, Coetzee will be monitoring the airport as it is used. He will analyze the data to confirm that his original analyses were, in fact, accurate. Using the same analysis technique, any future construction using the plastic grids can be evaluated.

If the construction technique is as successful as Coetzee and DOT&PF anticipate, then it could be used for other projects. The grids probably won't replace gravel where rock is plentiful and cheap. But in areas where gravel must be imported, the plastic honeycomb may provide an economical alternative.

A side benefit of using this construction method in rural Alaska is temporary local employment. Placing the plastic grids is labor intensive, but requires no special skills. At Shishmaref, the contractor (Brice, Inc.), hired 21 members of the community to open and spread the grids, secure them and fill the honeycomb pockets with the sand. Brice was very pleased with the quality of the work from their locally hired crewmembers, who earned more than \$143,000.

If the airport runway at Shishmaref works as well in reality as in the computer, then constructing runways and roads with plastic grids could become widespread in portions of western rural Alaska. **AT**

## News & Views

### 1987 Alaska Transportation Forum

The 4th Annual Alaska Transportation Forum will be hosted next spring in Anchorage by the University of Alaska Transportation Center (UATC). The forum is aimed at Alaskans who have a day-to-day interest in the Alaskan transportation system. Professionals and user groups involved in design, construction, operation or maintenance of transportation facilities in Alaska will gain information on current research that may be useful in the performance of their duties. Participants will also have the opportunity to influence the directions that future research will take. Presentations at these forums have encompassed a wide range of interests related to transportation in Alaska, including load restrictions, pavement condition trends, motor carrier safety, deregulation, planning case studies, economic studies, aviation concerns, design guidelines, road construction and materials, as well as open forum sessions for general discussion. The 4th forum is scheduled for 14 April 1987. For more in-

formation, see the "Request for Presentations" elsewhere in this issue, or call Dr. Nick Coetzee at 474-6124, John Martin at 451-5150, or Dr. Jan Botha at 474-7497.

### Highway Capacity and Quality of Flow

This course was recently offered in Anchorage as part of the Transportation Technology Transfer Program. Based upon the 1985 Highway Capacity Manual (Third Edition), the five-day short course provided participants with the skills to determine the traffic carrying capabilities for existing or planned rural and urban highways. Participants learned how to determine the level of service that can be provided to the traveling public, based on the geometrics and either the existing or projected traffic volumes. Participants also learned how to determine, based on capacity, the geometrics of new or reconstructed rural and urban highway sections, plus related features (such as interchanges and intersections) that are needed to accommodate the predicted traf-

fic demands. The course emphasized problem-solving techniques, including the use of microcomputers.

### Urban Transportation Planning

This three-day course, which was also taught in Anchorage, focused on how to effectively use the products of the planning process to support decision making at the project level. Participants learned how to use the urban transportation planning process more effectively for addressing state and local issues, and for supporting project-level decisions. The emphasis was on technology transfer: (1) how to let project development personnel and designers know what the planning process can provide (and the assumptions involved); and (2) making sure planners know how output of the planning process is used and what is needed at the project level. Examples, case studies and microcomputer applications were covered, along with pavement design issues as they relate to traffic forecasting.

## Current Trends in Pavement Design

A workshop on current trends in pavement design sponsored by the Transportation Technology Transfer Program was held in Fairbanks on July 9-10, 1986. Due to popular demand, we hope to offer this course in Anchorage sometime next year. Instructors from the University of Alaska-Fairbanks, the DOT&PF Research Section and Oregon State University discussed the current state of the art in pavement design.

Work included the new AASHTO pavement design guidelines and the current trend to mechanistic design procedures. Participants learned how these procedures work and how they can be applied. Each participant had the opportunity to work with one or more design procedures. The next offering of this workshop will be announced in a forthcoming issue of Technology for Alaskan Transportation.

## Request for Presentations

The 4th Annual Alaska Transportation Forum is scheduled 14 April 1987 in Anchorage. This is a request for presentations to be scheduled at the Forum. Interested parties should submit a synopsis of their pro-

posed presentation for review to the UATC Advisory Committee, Civil Engineering Department, 263 Duckering Building, University of Alaska-Fairbanks, Fairbanks, Alaska 99775.

Topics should address current issues and ongoing research relevant to transportation in Alaska. Formal papers are not required, but a short (one-page maximum) formal synopsis of each accepted presentation will be required for distribution to all registrants at the Forum. Presentations are scheduled for 30-minute time slots, of which at least five minutes must be available for audience participation. Additional discussion of topics may also arise during the Open Forum session.

To be considered for presentation, submissions must reach the UATC Committee no later than 19 December 1986. Speakers will be notified of acceptance by 31 January 1987, when a brochure and tentative program will be mailed to potential registrants.

The University of Alaska Transportation Center (UATC) was established in late 1983, and Transportation Forums have been held annually since 1984. Various topics have been presented, encompassing a wide range of interests related to transportation in Alaska, including load restrictions, pavement condition trends, motor carrier safety concerns, deregulation, planning case studies, economic studies, aviation concerns, design guidelines, road construction and materials, as well as open forum sessions for general discussion.

# Continuing Education

## Seminar on Real Estate Acquisition for Local Public Agencies

This seminar is designed for LPA (local public agency) personnel, state LPA coordinators, and Federal Highway Administration (FHWA) personnel who are responsible for implementing right-of-way programs. We hope to offer this course in the near future. The seminar is appropriate for individuals responsible for conducting or supervising the acquisition of rights-of-way for federal-aid highways. The seminar introduces a manual entitled "Real Estate Acquisition Guide" that was developed in response to the need to increase the knowledge of LPA personnel regarding the application of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Special emphasis is given to implementing regulations from the federal perspective. Each participant receives a copy of the guide for use as a resource document.

Upon completion of the seminar, participants should understand the relationships among FHWA, state and LPA right-of-way programs. Participants

will learn how to utilize the flexibility available in FHWA regulations for administering the real estate acquisition program. They will be able to identify opportunities for innovative approaches or practices in the area of real estate acquisition. Finally, each participant will receive a volume that answers regulatory questions that arise while administering a federal-aid highway right-of-way program. For more information, call John D. Martin at (907) 451-5150 or Dr. Jan Botha at 474-7497.

## Seminars & Workshops at Alaska Transportation Forum

A variety of workshops and short courses will be offered in conjunction with the next Alaska Transportation Forum to eliminate the expense of travel for people already participating in the forum. These educational opportunities will take place either before or after the annual forum, which will be held on 17 April 1987 in Anchorage. We will announce these courses in the next issue of Technology for Alaskan Transportation. Stay tuned.

### About Our Newsletter

Technology for Alaska Transportation is a quarterly newsletter that is distributed to all registered members of the Alaska Transportation Center. It provides information on current transportation issues in Alaska, including news, research, and technology. It also provides information on upcoming events, seminars, and workshops. The newsletter is published by the Alaska Transportation Center, University of Alaska-Fairbanks, Fairbanks, Alaska 99775. (907) 474-7497.

### Editor

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### About Our Program

The goal of the Transportation Technology Transfer Program is to help local agencies obtain information and training related to transportation planning, design, construction, and maintenance. In addition, we will provide information on current transportation issues, including news, research, and technology. We will also provide information on upcoming events, seminars, and workshops. The program is funded by the Alaska Department of Transportation and the Federal Highway Administration.

A variety of organizations support the Transportation Technology Transfer Program.

- the University of Alaska Transportation Center, Alaska Transportation Center, with participation from the Alaska Department of Transportation, Federal Highway Administration, and the Alaska Department of Transportation and the Federal Highway Administration.
- the Alaska Department of Transportation and the Federal Highway Administration.
- the Federal Highway Administration.

We invite you to address your questions or comments to any of the following individuals:

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## Calendar of Events

### 1986

**November 6—Joint Meeting of the American Water Resources Association and the American Fisheries Society.** Will discuss the possible substitution of culverts for bridges where fish passage will not be harmed. Anchorage.

**December 19—Deadline for submitting proposal for presentation at 4th Annual Alaska Transportation Forum.**

### 1987

**January 11—20th Annual Workshop on Human Factors in Transportation.** Washington, DC.

**Workshop on Bridge Management Systems.** Washington, DC.

**Workshop on Maintenance Management Systems.** Washington, DC.

**January 12-15—66th Annual Meeting of the U.S. Transportation Research Board.** Washington, DC. For more information on January meetings call Marilou Demón at (202) 334-2934.

#### Let's Get Acquainted

(continued from page 1)

publications, seminars and workshops, the results of the latest research, and instructional video tapes. We will talk about the latest technologies developed specifically for the unique Alaskan environment. We will suggest how to adapt some technologies to Alaska, and we will suggest which traditional technologies should be avoided in Alaska. Forthcoming newsletters will discuss the use and maintenance of road-building equipment, methods and materials suitable for construction, traffic engineering and safety, and the administration and management of local and rural roads.

Besides the workshops and seminars that we will conduct around the state, we will also help local authorities design and conduct their own training sessions. We will also provide a referral service; if you ask us a question we can't answer, we'll try to refer the question to a suitable specialist.

The publications that we will discuss in our newsletter will fall into three broad categories. We will talk about a number of free publications that we can provide upon

request. Some publications will be provided at our cost. And, finally, we will provide suggested reading lists on specific topics.

If you would like to receive a free subscription to this newsletter, complete the enclosed business reply card or see the section on page 3 entitled "About Our Newsletter." If you have a question or suggestion, contact anyone listed in the section on page 3 entitled "About Our Program."

And now a word from our sponsors. "Interdisciplinary" and "interagency" are bureaucratic buzzwords these days, yet the Transportation Technology Transfer Program is, in fact, supported by a diverse array of organizations. We receive substantial support from: the University of Alaska Transportation Center (UATC is a truly interdisciplinary group with participation from the schools of Engineering, Mineral Engineering, Management, and Agriculture and Land Resources Management); the Alaska Department of Transportation and Public Facilities; and the Federal Highway Administration. Technology for Alaskan Transportation will provide access to this formidable array of expertise. Subscribe today. It's free. **AT**

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